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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/597,366

07/21/2006

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OBA-40858

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116 7590 08/17/2011  
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EXAMINER

HOBAN, MATTHEW E

ART UNIT

PAPER NUMBER

1734

MAIL DATE

DELIVERY MODE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/597,366	<b>Applicant(s)</b> HIROSE ET AL.	
	<b>Examiner</b> MATTHEW HOBAN	<b>Art Unit</b> 1734	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2011.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,4,5 and 7-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4,5 and 7-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)         | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 18-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims include a lower bound on the range of  $\text{Al}_2\text{O}_3$  inclusion that cannot be found or supported in the disclosure as originally filed. Support for a lower bound of 0.5 and 0.7 wt% can be found in the examples and disclosure, but support for 0.6 wt% cannot. There's no evidence that the inventor considered the instantly claimed range to be an essential part of their invention. See MPEP 2163.05.

## **2.**

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 4-5 and 7 rejected under 35 U.S.C. 103(a) as being unpatentable over Tanimoto in 6514426 in view of Tajima in their publication entitled "Electric-Field – Induced Crack Growth Behavior in PZT/Al<sub>2</sub>O<sub>3</sub> Composites".

**Regarding Claim 1:** Tanimoto teaches a composition  $Pb_a(Mn_{1/3}Nb_{2/3})_xZr_yTi_zO_3 + b \text{ wt\% } MnO_2 + c \text{ wt\% } SiO_2$ , wherein a is between 0.985 and 0.998, b is between 0.155 and 0.5, c is between 0.01 and 0.09, x is between 0.045 to 0.2, y is between 0.29 and 0.425,

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and z is between 0.475 and 0.580. Tanimoto is focused on increasing the flexural strength of the piezoelectric material. This is done by including  $\text{SiO}_2$  in the composition.

Tanimoto is silent as to the positive inclusion of  $\text{Al}_2\text{O}_3$  as an additive.

However, Tajimi teaches that the addition of .5-1 vol%  $\text{Al}_2\text{O}_3$  is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains from the ceramic body. Tajimi noted better results at 1 vol% compared to .5 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi as highly beneficial and supplementary to those of Tanimoto, and would be motivated to include the  $\text{Al}_2\text{O}_3$  taught by Tanimoto based on the fact that the inclusion of  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$  are established to be for a common purpose of increasing the strength of the PZT based piezoelectric. Thereafter, it would have been obvious to one of ordinary skill in the art to combine said equivalents or to substitute them for one another in part or in whole (See MPEP2144.06-07). Furthermore, Tajimi and Tanimoto are highly combinable in that they both deal with PZT ( $\text{Pb}(\text{Zr},\text{Ti})\text{O}_3$ ) piezoelectric compositions. Based on the approximation that the density of PZT is roughly two times that of alumina, this results in from ~.25-.5 wt% of alumina in the composition.

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**Regarding Claim 4:** Tajimi teaches the addition of  $\text{Al}_2\text{O}_3$ .

**Regarding Claim 5:** Tanimoto teaches a powder consolidation method and thus the sample is polycrystalline in nature. Tajimi teaches at page 652 that  $\text{Al}_2\text{O}_3$  particles are incorporated both within the grains and along the grain boundaries.

**Regarding Claim 7:** Tajimi does not test these properties in his disclosure; however, the composition of Tanimoto in view of Tajimi would necessarily have these properties as it is of the same composition as that which is claimed. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP 2112.

5. Claims 8-10, 13-15 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanimoto in 6514426 in view of Masao in 3522182.

**Regarding Claim 8-10, 15 and 17:** Tanimoto teaches a composition

$\text{Pb}_a(\text{Mn}_{1/3}\text{Nb}_{2/3})_x\text{Zr}_y\text{Ti}_z\text{O}_3 + b \text{ wt}\% \text{MnO}_2 + c \text{ wt}\% \text{SiO}_2$ , wherein a is between 0.985 and 0.998, b is between 0.155 and 0.5, c is between 0.01 and 0.09, x is between 0.045 to 0.2, y is between 0.29 and 0.425, and z is between 0.475 and 0.580. Tanimoto is focused on increasing the flexural strength of the piezoelectric material. This is done by including  $\text{SiO}_2$  in the composition in an amount .

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Tanimoto is silent as to the positive inclusion of  $\text{Ga}_2\text{O}_3$  as an additive.

However, Masao teaches that the addition of from 0.05 to 5 wt% of  $\text{Ga}_2\text{O}_3$  to PZT based ceramics provides a dramatic increase in the mechanical quality factor,  $Q_m$ , of the piezoelectric.  $Q_m$  is an important property in piezoelectric as it is directly correlated to the amount of power loss in service and is also related to the gradual rise in temperature of a piezoelectric material during use. One of ordinary skill in the art of piezoelectrics would appreciate that an increase in  $Q_m$  would be applicable and greatly desired in the teachings of Tanimoto. They would have been motivated by the increased  $Q_m$  as a way of improving the overall composition of the material. One of ordinary skill would expect that the benefits seen in the PZT of Masao would also apply to the compositions of Tanimoto. Thereafter, it would have been obvious to apply these teachings to those compositions of Tanimoto.

**Regarding Claim 13:** Tanimoto includes  $\text{SiO}_2$  in an amount from 0.01 to 0.09 wt%.

**Regarding Claim 14-15:** Tajimi does not test these properties in his disclosure; however, the composition of Tanimoto in view of Tajimi would necessarily have these properties as it is of the same composition as that which is claimed. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP.

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6. Claims 11-12 and 16 rejected under 35 U.S.C. 103(a) as being unpatentable over Tanimoto in 6514426 in view of Masao in 3522182 as applied to claim 8 and 15 above, and further in view of Tajima in their publication entitled "Electric-Field –Induced Crack Growth Behavior in PZT/ $\text{Al}_2\text{O}_3$  Composites".

Tanimoto in view of Masao teach a composition  $\text{Pb}_a(\text{Mn}_{1/3}\text{Nb}_{2/3})_x\text{Zr}_y\text{Ti}_z\text{O}_3 + b \text{ wt}\% \text{MnO}_2 + c \text{ wt}\% \text{SiO}_2$ , wherein a is between 0.985 and 0.998, b is between 0.155 and 0.5, c is between 0.01 and 0.09, x is between 0.045 to 0.2, y is between 0.29 and 0.425, and z is between 0.475 and 0.580. Tanimoto is focused on increasing the flexural strength of the piezoelectric material. This is done by including  $\text{SiO}_2$  in the composition in an amount. Based on the teachings of Masao, it would have been obvious to add  $\text{Ga}_2\text{O}_3$  to this composition in order to increase its Qm.

Tanimoto is silent as to the positive inclusion of  $\text{Al}_2\text{O}_3$  as an additive.

However, Tajimi teaches that the addition of .5-1 vol%  $\text{Al}_2\text{O}_3$  is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains from the ceramic body. Tajimi noted better results at 1 vol% compared to .5 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi



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as highly beneficial and supplementary to those of Tanimoto, and would be motivated to include the  $\text{Al}_2\text{O}_3$  taught by Tanimoto based on the fact that the inclusion of  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$  are established to be for a common purpose of increasing the strength of the PZT based piezoelectric. Thereafter, it would have been obvious to one of ordinary skill in the art to combine said equivalents or to substitute them for one another in part or in whole (See MPEP2144.06-07). Furthermore, Tajimi and Tanimoto are highly combinable in that they both deal with PZT ( $\text{Pb}(\text{Zr},\text{Ti})\text{O}_3$ ) piezoelectric compositions. Based on the approximation that the density of PZT is roughly two times that of alumina, this results in from ~.25-.5 wt% of alumina in the composition.

### ***Response to Arguments***

Applicant's arguments and the amendments to the claims, see Page 10, filed 5/31/11, with respect to the rejection(s) of claim(s) 1, 8, and 15 under USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Tanimoto in view of Tajima etc. The newly cited prior art clearly shows the range of major, PZT-PMnN, claimed.

### ***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW HOBAN whose telephone number is (571)270-3585. The examiner can normally be reached on Monday - Friday from 10 AM to 6:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Emily M. Le can be reached on 5712720903. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C Melissa Koslow/  
Primary Examiner, Art Unit 1734

/Matthew E Hoban/  
Examiner, Art Unit 1734